MODIS SEMIANNUAL REPORT
- DECEMBER 1994 -

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RSMAS/MPO

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NAS5-31362

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Due to the interlocking nature of a number of projects, this and subsequent reports will contain coding to reflect the funding source. Modis funded activities are designated with an M, SeaWIFS with an S, Pathfinder with a P, and Headquarters with an H. There are several major sections within this report; Database, client/server, matchup database, and DSP support.

A. NEAR TERM OBJECTIVES
B. OVERVIEW OF CURRENT PROGRESS
C. FUTURE ACTIVITIES
D. PROBLEMS

A. NEAR TERM OBJECTIVES

A.1 Modis Objectives (M)

A.1.1. Continue to develop and expand the processing environment

- a. increase computational efficiency through concurrent operations
- b. determine and apply more efficient methods of data availability for processes

A.1.2. Begin extensive testing using global CZCS and AVHRR GAC data with database processing to test the following:

- a. algorithm capability
- b. machine and operating system stability
- c. functionality required for the processing and analysis environment

A.2 SeaWIFS Objectives (S)

A.2.1. Continue testing of processing methodology.
A.2.2. Continue to develop relationship between database and in-situ environment.

A.3 Pathfinder Objectives (P)

A.3.1. Expand matchup database as applicable.
A.3.2. Continue testing of methodology.
A.3.3 Train and integrate new personnel into Matchup Database processing scheme.

A.4 DSP Objectives (H)

A.4.1. Continue testing of processing methodology.
A.4.2. Continue to expand the number of sites supported.
A.4.3. Expand the supported hardware/software platforms

B. OVERVIEW OF CURRENT PROGRESS

B.1 Automatic Processing Database (P)

B.1.1 Operational Processing

B1.1.1 July Operational Processing

Product production was completed on weeks 29-51 of 1987.

B.1.1.2 August Operational Processing

The operational processing was taken over by Dalu Li. Most of the month, he concentrated on the processing through the production of the daily files, then assumed control of the weekly, post-processing jobs near the end of the month.

The end of the NOAA-9 data (weeks 8844-45) was reprocessed. It was discovered that some NOAA-11 passes had inadvertently been processed with the NOAA-9 data. Processing then proceeded with NOAA-11 data starting with week 8845. Weeks 8845-8916 where processed and product production completed for weeks 8845-8908.

B.1.1.3 September Operational Processing

Weeks 8917-8937 were processed and product production completed for weeks 8909-8924.

B.1.1.4 October Operational Processing

Weeks 8938-52 and 9001-9012 were processed and products produced for weeks 8925-52 and 9001-9002.

B.1.1.5 November Operational Processing

Weeks 9013-9046 were processed, and products produced for 9003-9036. A ten-day period at the end of 1987 that had earlier been skipped as we were missing the laser disk with the input data was processed.

B.1.1.6 December Operational Processing

Weeks 9047-52 were processed, and products produced for 9037-49.

However, data for 1991 was not immediately available, so processing was suspended until the equipment could be repaired.

B.1.2 Development

B.1.2.1 July - September Development

A number of major revisions in the server system were started and worked on during this three-month period, and the new system is

still in the testing phase. Except for a brief test period in early September, the more stable, operational system was used to run the processing, and will continue to be used until the new system has been thoroughly tested.

Changes to login.com - create ap_comfig.com and ap_build.com. There will be one file (ap_comfig) to define the disks, and then the directories will just follow that.

Changes to dir.defs - make BDISK, LDISK, etc., for the processing machines. then define all the GACSST,GACPST, etc. at once. Creates a set of environmental variables defining which server is to be used, and which types of jobs are to be run.

Eliminate explicit site references in the server software.

Eliminate remaining explicit directory references, substituting logical definitions (VMS) and environmental variables (UNIX).

Change some directory references from general directories to directories for individual servers at the same site. For example, ADDRECGAC writes a data transfer file to a temporary directory, previously defined as the logical ap_tmp. However, when two servers are run at the same site, these transfer files could be used by the wrong server. So, subdirectories were used, and pointed to by a new logical, ap_srvr_tmp. This had to be done in several cases.

The method used to trigger the daily and weekly jobs are being modified significantly. In the new scheme, each time an orbit is completed, the database will check to see if all orbits for that day, the previous day and the succeeding day have been processed. If so, the daily job will be triggered. A similar trigger for the weekly job is now used.

The mcp program that runs various jobs had previously been distinguished by appending the job type to the executable name (the mcp that ran "initial" jobs were named mcp-i). An alias was developed to eliminate the need for the extension. Also, a large set of command files that had been used to start various jobs on various computers was replaced by a single command file that parses input parameters to determine which jobs are to be run.

A mechanism has been added to assign all weekly jobs to the single "workhorse" computer when the records are added. Another mechanism queries the environment, and if requested, assigns the weekly3 jobs to the "local" computers that service the volume disks. This variable will be set to true for RSMAS, and false for JPL, as they do everything on one machine.

Two new jobs were added to the database records for future use, but have not yet been implemented or tested. One post-processing job and numerous backups are performed in increments of 2-8 weeks. These new jobs will run on four and eight-week increments of the

data.

The changes in the previous two months were tested, but problems are still present, so the processing was returned to the older system. There are also problems with multinet connections between client computers and the Alpha/OpenVMS server system. When these have been cured, the new APServer system will be tested.

On 12-16 Sept., three visitors from the US Naval Oceanographic Office visited RSMAS to discuss AVHRR/Pathfinder Processing.

B.1.2.2 October Development

The DEC-alpha version of the APServer was tested. This version repeated failed, and the problem was finally tracked down. A subtle bug in the commercial network package, MULTINET turned out to be the source of the problem. This was discovered late in the month, and testing resumed on the alpha version of the server.

B.1.2.3 November Development..

A new device, a digital tape library was installed. It will be used both to store the input GAC data files and the final PST and map Pathfinder files. Command files were developed to automatically back up the data.

The new day-triggering was tested and adjusted during the operational processing on mariah (a DEC-alpha).

On 16-21 Nov. two visitors from the Jet Propulsion Laboratory visited RSMAS to discuss AVHRR/Pathfinder Processing.

B.1.2.4 December Development

The APServe system was consolidated and tested on both VAX/VMS and the DEC/Alpha/OpenVMS systems.

Since the data flow rate has been about 21 days/day, the cloud-masking and product production steps have been run by hand, that is the jobs for each week have been run manually by the operator. In preparation of a significant increase in the data flow rate, these jobs are now being triggered automatically by the APServer system.

A new area, /usr/dsp/com2 was created, and all files use on the UNIX side will be put CVS source control and stored in this directory. As part of this process, The numerous command files that had been used to perform control and monitoring functions will be combined into a small number of command files that can perform the same tasks as directed by input parameters. For example, there were separate command file used to start the various mcp worker daemon, strti, for mcp-i, startu1 for mcp-u1, etc.; there is now a start command file that takes two input

parameters: start and mcp type. Similar command files for other control and monitoring functions are being developed.

In a similar manner, the command files for the VMS server side are also being consolidated and will be put under CVS control.

Finally, the DSP command file currently kept in /usr/dsp/com will be moved to /usr/dsp/com2, and put under CVS control.

The Alpha-compatible version of APServe was installed at JPL.

B.2 Client/Server Status (S)

B.2.1 July-December Client/Server Development

B.2.1.1 At the end of last year, Dalu Li worked with Mark Ruebens from GSFC to have the new version of VDC installed on IRIX version 4.

The VDC was later ported from IRIX version 4 to IRIX version 5,

B.2.1.2 Dalu Li wrote graphics interface for AP, which will help to monitor the AVHRR data processing at the end of the first quarter.

B.2.1.3 Dalu Li wrote graphics interface for DATABASE, which will help do database operations.

B.2.1.4 Dalu Li wrote graphics interface for network, which will oversee the FDDI connections.

B.2.1.5 Dalu Li wrote an interface frame between ECS PGS Toolkit and DSP. The frame contains the interface that DSP functions can use to call those basic PGS Toolkit I/O functions.

B.2.1.6 Dalu Li rebuilt the new version of VDC. The VDC we had was the one Mark Reuben helped build at the end of last year. Since then VDC has gone through substantial changes. We got the new version and rebuilt it in our environment. It is a partial rebuild. The mail handling function is not rebuilt completely and I plan to finish that soon.

B.2.1.7 Dalu Li processed AVHRR GAC data.

B.2.1.8 Dalu Li has been prototyping a more homogeneous data processing system that should reduce network activities and reduce the software complexity and make monitoring much easier. So far, I have gotten some core functions that can be run manually.

B.3 Matchup Database (P)

During this year, we continued the compilation of in situ sea surface temperature (SST) data from various sources to extend the

temporal and geographic coverage of the matchup data bases. We have extended our inventory of moored buoy data to December 1993. This includes the moored buoy data acquired from NOAA National Oceanographic Data Center (NODC) along the coasts of USA, Japanese Meteorological Agency (JMA) data along the coast of Japan and TOGA/PMEL data along the equatorial Pacific.

Similarly, the inventory of drifting buoy data from the world oceans was also updated up to December 1993 by obtaining data from NOAAÕs Atlantic Oceanographic and Meteorological Laboratory (AOML) and Canadian Marine Environmental Data Service (MEDS).

A list of times and locations at which NOAA-11 AVHRR data were to be extracted was prepared from in situ SST data for the years 1989 to 1993. The GAC data extractions and the build up of satellite-sea truth matchup data is complete for the years 1989 to 1992 while the extractions for the year 1993 are in progress. The four year long (January 1989 - December 1992) matchup data set is now being used for the development and validation of the of the SST algorithms for NOAA-11. The modified NLSST formulation proposed for NOAA-9 appears to work reasonably well for NOAA-11, with the exception of the period after June 1991, when both a change in internal blackbody temperature and the atmospheric aerosols injected by the explosion of Mt. Pinatubo caused significant problems in the performance of the algorithm. Further, all the available in situ SST observations for 1985 and 1986 were prepared for the extraction of AVHRR data. The GAC data extraction for these years is currently ongoing.

We have created a new version (version 18) of the matchup data base that includes the slope and intercept of the equation used to calibrate AVHRR counts into radiances. The reason for adding these values is that a sudden change in the blackbody temperature of NOAA-11 was noticed in data corresponding to mid 1991. The addition of calibration slope and intercept to the matchups allowed the detection of a strange behavior in channels 4 and 5. While a time series of slope values for channel 4 mimicked well the evolution of the blackbody temperature (as is to be expected), channel 5 apparently showed a smooth decay in the calibration slopes that is unrelated to blackbody temperatures. The reason for this unusual behavior is being investigated.

Addition of SSM/I derived water vapor values to the matchup data base.

During this year we implemented the addition of SSM/I derived integrated atmospheric water vapor concentrations to the matchup data base. After extensive experimentation with 3-day, 1-day and closest (the closest SSM/I measurement to AVHRR measurement in time and space) SSM/I water vapor fields we have decided to add 1-day water vapor fields to the matchups to minimize the effects due to mesoscale variability of the atmosphere. In some areas, the 1-day fields have included data from ascending and descending passes separated by 12 hours apart. We expect that the compositing have

not introduced significant variability in the daily water vapor fields. Creation of this new matchup data base, which included the water vapor in the In situ - AVHRR matchup, is complete for the years 1987 (from June) to 1988 (till November) for NOAA-9 and 1989 (January) to 1992 (December) for NOAA-11. The water vapor values added to the matchups are now being used in the evaluation of algorithms.

Radiative transfer modeling.

A new line of research started since the beginning of this year is the use of radiative transfer (RT) models that simulate the fate of radiance emitted by the ocean surface as it propagates through the atmosphere and reaches the AVHRR sensor. We obtained a copy of the RT model developed at the Rutherford-Appleton Laboratory (RAL) in the United Kingdom, and implemented it on our computer. We also obtained a set of 1200 world wide radiosonde measurements compiled and quality controlled by NOAA to simulate the radiative transfer through the atmosphere. We have extensively used the RT simulations to understand the radiative transfer process under various atmospheric conditions and to confirm the features detected from the matchup data sets.

Association between SSM/I derived water vapor estimates and AVHRR measurements.

Water vapor is the most important factor in the attenuation of infrared radiance propagating through the atmosphere, and has considerable influence on the performance of sea surface temperature (SST) algorithms. For that reason, during this year we devoted a significant amount of effort to explore the associations between SSM/I derived integrated water vapor estimates and various AVHRR quantities. We completed a study based on a data set that included co-located and co-temporal (i) in situ SSTs from drifting and moored buoys, (ii) infrared measurements from NOAA-11/AVHRR and (iii) integrated column water vapor from the DMSP-SSM/I sensor. In addition, we used the RAL radiative transfer model described above.

Our study showed that the association between the difference in brightness temperatures in AVHRR channels 4 and 5 and water vapor can be approximated by a two-piece linear fit with a break at about 3 g cm-2. This relation is influenced by the viewing geometry, as well as latitude and season. Radiative transfer model simulations show that, as water vapor increases, the relative proportions of ground and atmospheric radiance sensed by the AVHRR change. Furthermore, there is a change in the spectral composition of the sensed radiance that introduces a systematic deficit in the T45 values.

A comparison of various SST algorithms suggests that ancillary WV values have only a marginal contribution to the atmospheric correction problem. We compared three formulations of SST algorithms, namely, MCSST, NLSST and WVSST. The form of each

algorithm is as follows:

MCSST = -0.02 + 1.07T4 + 1.01(sec(SZA)-1) (T4-T5)

NLSST = 1.42 + 0.96T4 + 0.07(T4-T5)Tsurf + 1.04(sec(SZA)-1)(T4-T5)

WVSST = 0.88 + 0.99T4 + 1.38(T4-T5) + 0.19 WV(sec(SZA))(T4-T5)

where T4 and T5 are the brightness temperatures measured by the AVHRR sensor and SZA is the satellite zenith angle. To supply the Tsurf parameter, a first-guess SST, for the NLSST algorithm, random noise was added to the in situ SST. WV represents the water vapor content in the atmospheric column.

The first two algorithms (MCSST & NLSST) do not include an explicit water vapor term as the WVSST algorithm. Our results show that the NLSST algorithm outperforms the WVSST algorithm. This suggests that the use of ancillary water vapor values does not appear to enhance the SST estimates. We have also investigated the usefulness of water vapor values by generating a contour plot of temperature deficit (In situ SST - T4) on a (T4-T5)-water vapor plane. From the orientation of the contours, clearly the temperature deficit (or the correction required) has a far lesser dependence on the water vapor values than on (T4-T5) values.

A significant conclusion from our study was that the vertical arrangement of temperature and moisture in the atmosphere may introduce significant variability in the radiances sensed by the AVHRR, and this topic will be investigated in the future. The results of this study were submitted for publication to Remote Sensing of Environment.

B.4 DSP Support (H)

B.4.1 Testing:
B.4.1.1 Third Quarter Testing:
None listed

B.4.1.2 Forth Quarter (Oct.-Dec.)
None listed

B.4.2 Modifications/Additions to DSP:

B.4.2.1 Third Quarter Modifications/Additions to DSP:
SSBIN-HDF: Add quality checking; use L3-Binfiles.v3.2 routines. Use v3.3 interface routines. (Still using tau band for flags.) Use HDFLIB from make.1. Take out unused include file: calibration.h. Comment out unused include files.
STBIN-HDF: Add quality checking; use L3-Binfiles.v3.2 routines. Take out debugs.
Use links instead of specific directories in makefile; put flags in tau band (instead of eps band).
SMAP9-HDF: Add quality checking; use L3-Binfiles.v3.2 routines; add output of flag bands.

Use v3.3 interface routines. (Still using tau band for flags.)
Use HDFLIB from make.1; check for chlor_k490 before checking for chlor.
ANLY8D: Add satellite zenith angle check.
Make compatible with Read_Cal v3.1 distribution.
Correct handling of ANCHOR$C to multi-resolution input files.
Add support for V3.3 I/O spec.
Use symbols HDFLIB and HDFINC defined in etc./make.1.
Add epsilon output value (byte).
Use calfixit to find ancillary data files.
Change Carder Q from 5.9 to 3.42.
Disable La670 test in Cocco flag test.
Disable interpolation between scan lines pending decision on read ahead logic.
PATHNLC: Add checks for satellites and years. Allow NOAA-9 1987 and 1988; and NOAA-11 1989 through May 1991.
OA2PST: Bin data from a binary oa file into a pathbin type pst file.
LOADDB: New program to read history file listing of dbman output and populate netcdf dbman files.
RTLIB: Include "rtlib.h".
COLORSHR8: Switch to using HDF 3.3r3p1 library. Add support for V3.3 I/O spec.
Remove references to HDF directories .. not needed.
MIA2GIF: Remove palette number keyword. Add new keyword "PAL" that accepts palette file and palette number. If palette number is specified but not palette file, palette number refers to the input image file.
Add code needed on big endian machines.
HDF: Add linux support.
MAKETC: converted from adage system to Unix.

B.4.2.4 Forth Quarter Modifications/Additions to DSP:
COLORSHR8: Add CZCS aerosol tau calculations (Missing TILT and SCAN ANGLE data), this adds a new file /usr/dsp/cal/seawifsaer.cal.
Disable CZCS specific path (calni7, calslp).
Remove calni7 and calslp from library (only used for CZCS).
ANLY8: Add CZCS aerosol tau calculation for 865. Correct Cocco. test.
Update status comments at top of program.
Add Carder chlorophyll algorithm (missing some necessary pieces but good enough for timing tests).
New calibration file: /usr/dsp/cal/carder_params.dat
Iterate on 'Remote Sensing Reflectance' for Carder chlorophyll calculation.
Can't have declarations after DATA statements.
Add support for calibration routine calibrate_l1a to apply all basic sensor Calibrations and corrections to the raw data stream.
Change type of bit mask to "int".
Finish change of bit mask to type 'int'.
Declare "secnds". It should be really not be there.
Flip flag bits 3 and 10; use calfixit in wang_czcs to find cal files.

Add l2_scale.rat, upgrade to v4.1 of interface spec.
Add additional QC bands.
Add chlorophyll failure test/flag bit.
Add separate L2 calibration tables for reading/writing L2 HDF data files.
Ingest library: Add routine, CMPBUFFER, to pack 3 10-bit words into one 32-bit word. Add CHECKSYNC, TIMESCR, FFCSWITCH, SCANFORSYNCH, SCANBACK,GETPSEUDOTIME, and READRECORD for QRMPACK.
Define entrsc_ and writsc_
QRMPACK: New "ingester" to convert a Quorum disk file to a Miami archive disk file.
QUORUM: New ingester to read Quorum data.
PATHREF: Use bit mask to select bins from input pst to be put in output pst.
MIA2JPEG: Convert DSP image to JPEG.

B.4.3 Problems fixed:
B.4.3.1 Third Quarter [July - September] Problems Fixed:
DBMAN: Take out some debugs. Use all lower case letters in the database file names.
Fix a comment.
LOADNOHED: Add wait for last asynch write.
PATHBIN: Take out debug statements when a bin number larger than 6000000 is calculated.
CLIP: Fix description of program to say bound instead of zero.
DSP: Change the name of the DSP function "stat" to "fstat".
Add more string frees and two error messages.
Remove definition of "INSTALL".
ADD: Don't bound bias; set in1 open flag properly.
PALSAV: Remove RTLIB #defines, they are now in $DSPROOT/inc/rtlib.h
PAL: Remove RTLIB #defines, they are now in $DSPROOT/inc/rtlib.h
EXIST: Remove RTLIB #defines, they are now in $DSPROOT/inc/rtlib.h
COLORSHR: COLORSUB.C: Remove some #defines, they are in rtlib.h now.
COLORSHR5: COLORSUB5.C: Remove some #defines, they are in rtlib.h now.
COLORSHR7: COLORSUB7.C: Remove some #defines, they are in rtlib.h now.
Add support for Anc-files v3.2.
Source sync tool.
Disable DEBUG flag included in distribution of v3.2.
Add support for V3.3 I/O spec.
Use symbol HDFINC defined in etc./make.1.
Check-Anc getanc.c makefile
Use calfixit to find ancillary data files.
Fix calls to get_ancillary.
GETCOM: Remove #define's now in rtlib.h.
MCSST: Remove #define's now in rtlib.h.
CALLER: Make a copy of the process name before removing '%'.
VMSLIB: STRINGS.L: Add linux support. RTLIB: STRINGS.H: Add linux support.

VMSFORLIB: ACCESS.C: Add linux support.
IO: CALIBRATION.C: Add linux support.
LOOP: Fix to allow up to 16 planes, and add option to specify just the number of planes to loop and the number of the first plane.
SHPSPH: Fix decodes to work on all machines.
VHRR: Fix decodes to work on all machines. PALHST: Fix palhist to call iaccum1 correctly.
Fix some more decodes to use formats instead of *.
TWOLINE2PPT7.C: Add error checking to grejul and julgre.
Correct range check in julgre for selecting proper table entry.
Disable debugging in makefile.
XFLOAT.C: Down-case the names of the functions xfloat and xfloati.
ORBIT: Use functions when mixing variable types, don't let compiler do it.
MAKEPPT7: Fix makefile rule for unix.c.
Disable debug options.
Remove unnecessary blank lines from output file.
APP2PPT7: Disable debugging in makefile.
PRINTPPT7: Disable debugging in makefile.
PUTNLPPT7: Disable debugging in makefile.

B.4.3.2 Fourth Quarter Problems Fixed (Oct.-Dec.)

Ingest library: Remove extraneous argument in entrsc call.
MAKE-BSD: Slight mod for IRIX 5.2.
Change for OSF/1 V3.0, getopt is prototyped differently.
Add support for linux and FreeBSD.
QRMPACK: Move ffcswitch to ingest/lib.Fix switch parsing.
Fix file name in error messages.
Add ability to skip files on a tape.
Search for synch pattern.
IMG2OA: Use single quotes in open statement so it will compile on VMS.
Declare "iand".
RTLIB, FIXIT: Strip out filename from default directory string if present.
VMS needs different include files.
RTLIB, STRINGS: Add linux and FreeBSD support.
SCRIPP: Fix printing of rename error code.Correct oversight in day/time
handling for missing lines so that scripp gives same result(s) as quorum.
Handle sea space data with long records.
VHRR: Use ' instead of " in data statements. Use Dsp_GetScreenSize* instead of NNNLIN and NNNPIX.Change "jint" to "ifix".
SHPSPH: String array fix for VMS.
SHARP: Define scopy.
IO library, PARSER: Fix spelling in error message.
IO library,CALIBRATION,IMAGEWRITE,IMAGEREAD: Fully prototype ntohs and family.
Include the correct header files for ntohl and family.
OA2PST: Raise AZSIZE, max expected bins to 400000 from

282000.
OISST: Fix output file name.
PATHNLC: Allow 1994 data.
PST2OA: Add message to show how many bins are written.
SCALE8: Add vaxcrtl for VMS.
SMAP9-HDF: Add status code to an error message
MAKETC: Add maketc to Unix version of dsp.
111111,2CHAN,ANLY2A,ANLY2C,ANLY2D,ANLY5C,ANLY5D,ANLY6
D,ANLY7D,ANLY8D,

CALEPS,FINDPOLES,GETCOM,PATHNLC,MAPEPS2,MAPEPS5,MAP
EPS7,ORBIT,ORBITSHR,
 PATHSST,SPHLIB: Remove extra F2C options from makefile.
GETCOM: Add linux and FreeBSD support.
IMGTOFMT,MIA2HDF,CDFIO: FreeBSD doesn't need declaration of
sys_errlist.
MIA2HDF,XFBD,HDF,VMSLIB,CALLER,DSP: Add support for linux
and FreeBSD.
PAINTR: Update F2C options.
PATHBIN,PATHCLOUD,PST2OA: On Unix, declare "ishft".
XFBD: Rework the HOST_ORDER and NET_ORDER macros, ntohl
might be a macro and not a dummy. Add include of StringDefs.h,
some systems need it to
Find XtNborderWidth.
FB library, X-LIB: Conditionalize declaration of debug buffer.
FB library,FB: Add missing dummy arguments in "xfbini" call.
VMSFORLIB, ACCESS: A minor formatting change.
WRKTLK: "msync" the region if using MMAP.
CALLER: On Unix, the exit handler should not call "exit", call
"_exit" instead.
MENU: On linux, use "ncurses" instead of regular "curses" library.
SLD: Use "$F" instead of "0" to initialize variables.
PATHBIN: Change type of bit mask to "int".
AES10: Fix up character/integer handling in ntohl function. Don't
use "merge" as a subroutine. Remove declaration of "BMAGIC".
AES: Use smove instead of a DO loop to copy label. Don't use
"merge" as a subroutine.
ANLY7D: Declarations have to occur before DATA statements.
QUORUM: Handle bit errors in time that caused spurious missing
lines.
Correct oversight in day/time handling for missing lines so that
quorum gives same result(s) as scripp.
LOOP: Remove type declaration for "loopmain," it's a subroutine.
WHEREPST: Remove declaration of Dsp_CalEvl.
SOLVELPS: Fix default argument parsing, fix dim file lat/lon value
decoding,
conditionalize graphic output for batch runs. Change DRAWIT to
logical;
fix string handling.Read navigation when open input image.
MICE: Add type cast to generated "bzero" call.
DSP: Don't include rtlibshr, it should be automatic.
REMAP: Fix output bit size for remapt 16 and 32 bit input files.

B.5 Direct Project Support

B.5.1 SeaWIFS (S)

B.5.1.1 July

i. The following activities were performed by Jim Brown of RSMAS is support of SeaWiFS during a trip to the Washington, D.C. area:

Worked with Gene Feldman:

o Installed current DSP Unix software on his SGI system.

o Completed implementation of Gordon/Wang atmospheric algorithm. Testing determined that significant internal changes were necessary to reduce run times. Biggest improvement was by only reading each parameter file once and only calculating certain intermediate data values once. [Testing was completed when Jim returned to Miami. Still investigating methods to further speed it up.]

Worked with Stan Hooker:

o Attempted to get DSP running on NeXT 3.0 and AUX 3.0. Both attempts were failures for different reasons. On NeXT, there are fatal problems in how they have implemented shared memory. Current DSP shared data structures depend on using shared memory. On AUX, something fundamental is wrong with either a) system malloc library or b) system compiler/run time. Everything works fine until DSP program starts up and then DSP dies with an unexplainable malloc failure. Angel attempted to debug AUX malloc problems with no success.

o Collaborated with Stan, Denny Kerwin(Old Dominion), and Richard Mead(NRL) to assemble dataset that supports theoretical and model work Denny and Richard are doing. This paper attempts to explain fundamental dynamic behavior of associated vortices of warm core rings (particularly of ring 82-B in spring 1982).

o Mentored person learning LabView programming.

o Fought with networking folks: network didn't work properly (several times).

Helped Wayne Esaias:

o Stan and I set up two SGI Indigo workstations (so we could use DSP on one of them).

Visited Dennis Clark (NOAA):

o Met with Dennis. Failed in attempt to get his Mac networking software configured and running. Unclear if hardware or software problem was the culprit.

o Mentored Eric about various Mac programs we (Stan and I) developed on MOCE cruise to quality control and clean up the various collected datasets.

ii. Jim Brown worked with Wang, Gordon to incorporate SeaWiFS Rayleigh-aerosol interaction code, epsilon calculations in to the processing system. As a result, throughput increased from 1 pixel/sec to 170 pixel/sec.

iii. A test image was processed for 79160 east coast US with haze front. As expected, variability present in 550 nm band translated into epsilon variability. A 4x4 subsampled image requires 12 minutes to process using new ANLY. Data for test

pixels from the test image have been compared using outputs from ANLY and Wang's test programs; the two program set produces the same results demonstrating that the algorithm is correctly implemented.
iv. Wang extended the potential epsilon range by adding code to implement the semi-log epsilon equation when the epsilons computed by the 12 models do not produce an epsilon within their range of applicability.
v. Gene Feldman will create a copy of the VDC process control software for installation in Miami. The basic CZCS processing will be duplicated, then substitution of SeaWiFS modules for CZCS modules will begin.
vi. The implementation of trigger conditions and database structures that support the data day and equal area grid concepts used by the binning programs have been completed. These conditions and structures are being documented for transfer to Gene Feldman.
vii. A series of discussions has been help with Chuck McClain to define masking approaches for SeaWiFS. These will likely follow the model used for Pathfinder SST processing where an initial set of flags is generated during or immediately following level-2 processing, e.g.., cloud mask and sun glint, and subsequent set of flags is generated by program or interactive analysis of the global daily fields. Incorporating time is being considered as an added dimension and possibly additional external fields. These discussions will continue.

B.5.1.2 August

i. Jim Brown continued working with Wang, Gordon to incorporate SeaWiFS Rayleigh-aerosol interaction code, epsilon calculations in to the processing system.
ii. The implementation of trigger conditions and database structures that support the data day and equal area grid concepts used by the binning programs has been completed. These conditions and structures have been documented and transferred to Gene Feldman.

B.5.1.3 September

i. Teleconferences and phone conferences. A number of teleconferences and phone conferences have been held to expedite the exchange of information between the Miami and Sea WiFS teams. These exchanges were highly productive and helped define areas requiring greater attention.
ii. Bob Evans reviewed draft specifications for Level 1 to 3 HDF files to determine if sufficient information is retained for Seawifs processing. This in turn initiated a review of the L2 and L3 processing routines to ensure that all required variables are computed. Results of these analyses have been exchanged with SeaWiFS project personnel.
iii. The Gordon algorithm for Seawifs atmospheric correction has been implemented together with the ancillary data HDF routine. The ancillary data have been incorporated into the atmospheric

correction by including pixel level pressure and ozone calculations. Wind speed is used to compute the sun glint mask. The new ANLY7 level 2 program has been used to determine computation times for Seawifs by simulating 6 Lw channels. Results to date suggest that the SGI Challenge upgrade will be able to process Seawifs GAC data at approximately 12 times real time.
iv. In addition to the timing tests, a series of algorithm tests was conducted using several scenes were both the CZCS algorithm and the Seawifs algorithm using CZCS data could be expected to yield comparable results. A special version of the CZCS Level 2 program ANLY5 was developed implementing pixel level epsilon computations (MAPEPS5). The three programs (ANLY5, MAPEPS5, ANLY7) produced normalized Lw within approximately 0.5 count.

B. 5.1.4 October

Continued to integrate updated routines into ANLY and BIN programs. Telecon with SeaWiFS to discuss quality flags and implication for support in I/O routines. Initial discussions with DAO to use their assimilated fields for ancillary data. Requested that they implement a data extraction model that corresponds to the SeaWiFS orbit and ground observations. Possible data for implementation Spring, 95. Will need updates for algorithms from SeaWiFS cal/val for K and cocco algorithms. Discussed parameter files and status variables to write to processing data base. Will also need Tau data from Howard models.

B. 5.1.5 November

Jim Brown working with D. Clark for next Optical Cruise. Received second generation atmospheric correction code from H. Gordon. Codes tested using test data provided by Howard. Next activity will be generating an interface that will integrate the new routines into the ANLY program. Sue working with next update to HDF routines.

B. 5.1.6 December

Jim continued to work with new correction codes following return from Hawaii. Sue working the SeaWiFS project to reconcile L1 test data and HDF I/O routines. Discussed remaining work areas for SeaWiFS programs with C.McClain while in Japan.

B.5.2 MODIS (M)

B.5.2.1 July

i. Bob Evans worked with Gordon and Brown to develop their Algorithm Theoretical Basis Documents.
ii. Bob Evans supplied Al Fleig with estimations of computation times for Brown's SST and Gordon's water leaving radiance computations based on Pathfinder SST and prototype SeaWiFS algorithm implementations. The algorithms were used to process

data sets representative of a day's processing.
iii. Bob Evans attended, with Jim Brown, a Hughes pre-System Readiness Review meeting, and they discussed both MODIS processing and distributed processing at SCF's.

B.5.1.2 August

i. Bob Evans continued worked with Gordon and Brown to develop their Algorithm Theoretical Basis Documents.

B.5.1.3 September

i. Bob Evans continued work on the ATBD.
ii. Bob Evans attended MODIS science meeting
iii. Bob Evans and Pete Evans attended EOSDIS SRR for V1.
iv. At the DIPFT, Bob Evans suggested that SCF and PGS processing be made as equivalent as possible such that any scripts, tests, processing... would produce identical results independent of processing environment. Further, rapid emergence of high speed workstations means that substantial processing and analysis can be conducted at the SCF. This in turn requires that network bandwidth and DAADS delivery of products to the SCF needs to be checked for proper sizing.
v. Bob Evans reviewed reports from data processing focus team requested information on data sets to be produced by Dennis Clark during mooring and cruise work.
vi. Test data sets were defined for MODIS, 4km data daily, global for ocean visible and infrared channels to construct calibration and algorithm test fields. A limited number of 1km calibration sites will also be established corresponding to mooring locations or cruise tracks. Expect that calibration updates due to long term drifts in the sensor performance will result in 1 - 2 changes in the calibration per year.

B.5.1.4 October

MODIS team meeting. Identify sources of ancillary data. Initiated discussions with R. Rood to use fields from the DAO. Assuming that we can obtain appropriate resolution and vertical coverage, the DAO fields when extracted to correspond with MODIS overflight will eliminate the need to spatially and temporally interpolate.

Discussed cloud masks with Menzel. His group will deliver code and test data for evaluation. Work with Masuoka for beta delivery. We will integrate science code and delivery to Ed where the Toolkit and MODIS HDF I/O functions will be added. Beta will be based on SeaWiFS and we will incrementally substitute MODIS algorithms are they are available.

B.5.1.5 November

DEC TL820 DLT tape jukebox arrived and installed. Defining procedures to allow unit to archive data files as well as provide

backup for software libraries and data bases.

Jim Brown providing cruise support for D. Clark. Integrating in situ data acquisition system.

B.5.1.6 December

At AHWGP, discussed processing and data requirements with Masuoka and panel. Investigate conversion of L2 codes to Fortran 90, will interact with Steve Fox (Hughes) and provide Rayleigh and Rayliegh/aerosol interaction routines as test projects. Discussed needs for process control flow. Will follow up with Hughes to determine if the EOS processing environment will properly support MODIS ocean processing. Discussed cost model and processing capacity as this relates to MODIS.

B.5.3 Pathfinder (P)

B.5.1.1 July

i. The matchup data for NOAA-9 has been used by C. Walton/NESDIS and Miami to produce candidate AVHRR algorithms. These have been compared in Miami to determine existence of trends with respect to time, surface temperature, and scan angle. Tests have been conducted for the ensemble of fixed moorings, drifting buoys, and for individual buoys.

ii. A candidate algorithm that has the least residual trends and approaches the minimum RMS error was chosen for the final run of test calculations.

iii. The rate of test calculation production has been steadily improved through reorganization of the production flow and through introduction of DEC/ALPHA processors. At present we are able to sustain 15 data days/day and approach a maximum of 20 days/day. This limit is imposed by the maximum rate at which files can be retrieved from the optical juke box.

iv. A change was introduced into the system to split the full level-1 files into ascending and descending segments during ingest time. This change improves throughput by eliminating checks to determine whether a pixel is located in an ascending or descending segment when the level-1 data crosses the poles. Unfortunately the fast navigation package obtained from the University of Colorado (Bill Emery) does not produce reliable computations of the pole crossing times. This in turn misclassified an unacceptably large number of SST retrievals. We have replaced the pole crossing time calculation with a slower, but reliable, program based on the Miami navigation routines and have calculated new crossing times. These times are now used for global processing yielding complete coverage maps for each daily ascending and descending (day and night) SST field.

v. Computations are proceeding and fields are now available for routine transfer to JPL for final quality control review. The complete processing and scheduling package will be transferred to JPL.

vi. Jim Brown assisted Richard Legeckis (NOAA) with the

following to prepare for receipt of Pathfinder data:
o Installed various VMS software updates.
o Installed DAT tape drive.
o Diagnosed local terminal LAT connection problem.
o Installed SONY optical disk drives/interface.

B.5.1.2 August
i. Testing continued using the matchup data sets.
ii. Efforts continued to define objective test fields for Pathfinder data using 1988 data.

B.5.1.3 September
i. Objective tests of pathfinder fields for 1988 data were defined by using objectively interpolated weekly 1 deg (360x180) spatial resolution maps produced by Dick Reynolds. Reynolds provided fields that were FTP copied to Miami and read using a template program.
ii. Comparable 1 deg weekly maps were produced using the 9 km, daily PST files. We now have the capability of spatial and temporal averaging to produce the desired resolution products.
iii. The Reynolds and Pathfinder files have been subjected to two tests. These include time differences of each data set (week N - week N-1) to test for temporal continuity and reasonable geophysical change. The Reynolds time difference fields show areas of blocky or patchy temperatures whereas the Pathfinder fields tend to be smoother. The Reynolds - Pathfinder differences show substantial areas with absolute differences less than 0.3C. Both fields show seasonal changes as time progress from January to July. The R - P fields show difference no greater than the weekly Reynolds differences.
iv. Future research questions exist as to how to determine the best method(s) to insure field quality given the temporal and spatial distribution as well as quality of the available in situ data sets.
v. We have received Reynolds fields for 1987 to the present. Equivalent Pathfinder fields for the first 6 months of 1988 including fields of counts, rms, means, and differences.
vi. The results of the algorithm tests and Pathfinder-Reynolds comparisons were presented during the Ocean SWG Pathfinder meeting on Oct. 14. At the meeting the NLSST and Miami equations were presented and a number of additional tests were suggested.

B.5.1.4 October

PO.DAAC User Working Group. Defined processing and data delivery for the Pathfinder Project. JPL will request optical platters for 1985 and 1986. Miami will duplicate, develop matchup data base, and generate coefficients for Pathfinder equations. JPL will process N-11 data until mid 1991 prior to the eruption of Pinatubo. Miami will deliver fields for 1989 and 1990. JPL then will have all data processed from 1987 through mid 1991. JPL will process 85 and 86 when equation coefficients become available.

B.5.1.5 November

Arranged with Doug May of NRL to have access to near real time in situ observation (buoys). This will be especially useful for the upcoming launch of N-14

B.5.1.6 December

Using radiative transfer codes to augment matchup data base investigations. Investigating alternative retrieval equations.

B.6 Team Interactions

B.6.1 July

B.6.1.1 Robert Evans and Jim Brown attended a meeting with Hughes and discussed machine to machine scenarios for use with V1 ESDIS.

B.6.1.2 Peter Evans participated in both the DOAFT session and a EOSDIS V0 review.

B.6.1.3 Robert Evans attended a meeting of the Data Processing Focus Team.

B.6.2 August

B.6.3 September
A number of teleconferences and phone conferences have occurred on support of SeaWiFS. Additional meetings for the V1 SRR, DOAFT, and DIPFT were attended.

B.6.4 October

PO.DAAC. Discussed budgets and goals for coming year.

B.6.5 November

Abbott/Butler meeting on future computer system directions. Discussed possible interactions with vendors to help define processing methodology. Will prepare description of MODIS/Pathfinder processing as template.

B.6.6 December

ADEOS/OCTS meeting in Japan. Discussed international Calibration and Validation efforts. Data exchange will involve use of EOS standards.

C. FUTURE ACTIVITIES

C.1 Database Future Work

C.2 Client/Server Future Work
Continue development of programs to support SeaWiFS in the VDC

environment.

C.3 Pathfinder (P)
C.3.1 Continue development with 1 deg (360x180) spatial resolution maps produced by Dick Reynolds.
C.3.2 Continue algorithm tests and Pathfinder-Reynolds comparisons. Present results at Ocean SWG Pathfinder meeting.

C.4 Headquarters (H)
C.4.1. Create tools to assist in result's interpolation.
C.4.2. Verify workstation DSP (SGI, SUN, DECstation, VAXstation) by comparing each program's output with the Adage system.

C.5 Modis (M)
C.5.1. Use test data sets developed to continue test criteria.
C.5.1 Complete ATBD.

C.6 SeaWIFS (S)
C.6.1 Continue testing of Gordon's algorithms and its interaction with HDF ancillary routines.
C.6.2 Continue timing tests with CZCS and SeaWiFS algorithms.

D. PROBLEMS

D.1 Database Problems

None listed separately

D.2 Client/Server Problems

None listed separately

D.3 Matchup Database Problems

None listed separately

D.4 DSP And Headquarters Related Problems

None listed separately